2

Structure

Thus far, we have conceived of a grammar as comprising at least three components (or sets of rules), namely:

(1) (i) *syntactic* rules of sentence-formation, which specify how to form sentences

(ii) *semantic* rules of sentence-interpretation, which specify how to interpret the meaning of sentences

(iii) *phonological* rules of sentence-pronunciation, which specify how to pronounce sentences

Henceforth, we shall be concerned almost entirely with the *syntactic* rules. Thus far, we have required that the sentence-formation rules of the syntactic component of a generative grammar perform two tasks:

(2) (i) generate all and only the grammatical sentences of the language (i.e. specify how words can be combined to form sentences)

(ii) assign an appropriate syntactic structure to the sentences concerned which accounts for the native speaker's intuitions about the structural relations between the words in a sentence

Before we look at how we might go about tackling (2) (i), let's look more closely at (2) (ii) – the question of what we mean by saying that sentences have an internal syntactic structure, and how we can represent that structure.

Chomsky argues that the native speaker intuitively knows more about the syntax of his language than just which sequences of sounds can be combined in what order to form grammatical sentences. More specifically, the native speaker intuitively recognises that sound-sequences in sentences are structured into successively larger sets or groups which we call *constituents*. Even the spelling system of English recognises this (albeit sporadically), by grouping sound-sequences into *words* (bounded by a space),

phrases (bounded by a comma) and *sentences* (bounded by a capital letter and full stop). If sound sequences had only *linear* structure (whereby one sound precedes the next), then sentences would be written as a continuous sequence of sounds – e.g.

(3) Thisboywillspeakveryslowlytothatgirl

But sentences aren't unstructured linear sequences of sounds: any native speaker of English can tell you that the sounds in (3) are grouped into *words*, and can tell you what the word-divisions are. We'd all agree, for example, that the word-divisions in (3) are those in (4) below:

(4) This boy will speak very slowly to that girl

and not those in (5) below:

(5) Th isb oywillsp eakv erys lowlytot hatg irl
T his boyw ills peak ver ysl owly toth atgi rl

But although the English spelling system provides a systematic representation of the way sounds are structured into words, it generally provides only a very inadequate, inconsistent and sporadic representation of the way in which words are structured into phrases. For instance, we'd all agree that in (4) *very* 'goes with' or 'modifies' *slowly*, and not e.g. *speak* – and yet our spelling system provides no representation of this fact. One way in which we could represent this type of structural relation diagrammatically is by grouping the two words together into a single set, e.g. as follows:

(6) This boy will speak very slowly to that girl

Likewise, we'd all agree that *that* in (4) 'goes with' *girl*, not with e.g. *to*. Once again, we could represent this intuition by grouping the two words together into a single set as follows:

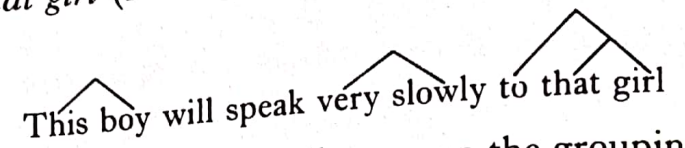
(7) This boy will speak very slowly to that girl

And in much the same way, we all share the intuition that *this* 'goes with' *boy* – a fact which we can represent as:

(8) This boy will speak very slowly to that girl

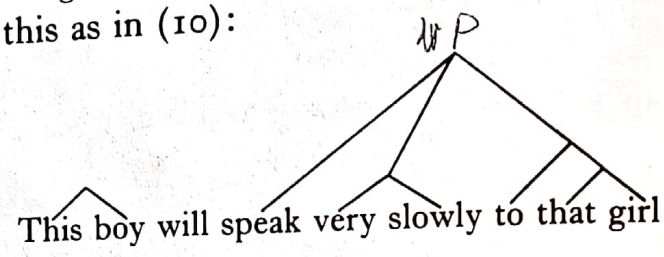
Furthermore, it seems intuitively obvious that *to* modifies the phrase *that girl* (not e.g. *very slowly*); this we can represent as:

(9)



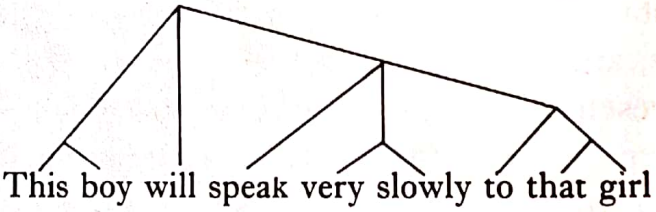
Thus far, we'd probably all agree on the groupings that we have proposed. At this point, however, our intuitions tend to become rather more cloudy. Some people would argue that *speak very slowly to that girl* is also a structural unit, a *phrase*: if so, we might represent this as in (10):

(10)



Finally, the whole sequence *This boy will speak very slowly to that girl* is also a structural unit or constituent – one which we traditionally call a *clause* or a *sentence*: i.e. we intuitively know that the words in (4) form a single sentence, rather than two or three separate sentences. We can represent this by grouping all the phrases we have established so far into a single set, as follows:

(11)



The diagram (11) now provides a schematic representation of our intuitions about the internal syntactic relations between the various words and phrases in the sentence (4).

But even now we haven't exhausted our intuitive knowledge of the syntactic structure of sentences such as (4). For, we know not only which sequences of sounds form constituents (i.e. structural units), but also which constituents are *constituents of the same type*. So if someone asked us whether we feel intuitively that *boy* and *speak* are constituents of the same type, we'd probably say: 'No, *boy* is a *Noun*, and *speak* a *Verb*.' But we'd want to say that *boy* and *girl* are constituents of the same type – namely *Nouns*. By the same token, we'd intuitively recognise that *this* and *that* are constituents of the same type, which we might call *Determiners*. Similarly, we'd

probably recognise that *will* is the same kind of constituent as *can*, *may*, *must*, *would*, *might*, etc. – i.e. is a constituent of the type traditionally called an *Auxiliary*. And we'd intuitively recognise that *to* is the same kind of constituent as *with*, *from*, *by*, *at*, *in*, *for*, etc. – namely a *Preposition*. Finally, we'd probably agree that in traditional terminology *slowly* is an *Adverb* (of manner) just like *carefully*, *quickly*, *patiently*, etc., and that *very* is a *Degree Adverb* like *quite*, *rather*, *somewhat*, and so forth. We can represent this information in an obvious way by labelling each of the words in (4) according to its type or *syntactic category* – e.g. as follows:

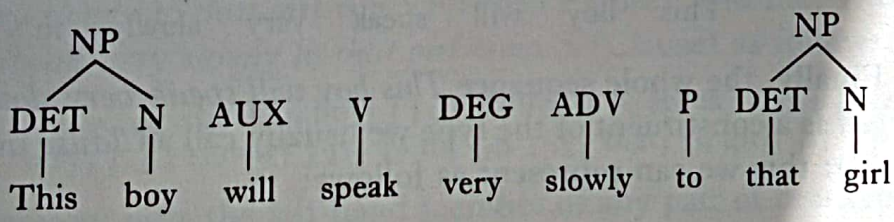
(12)

DET	N	AUX	V	DEG	ADV	P	DET	N
This	boy	will	speak	very	slowly	to	that	girl

DET = Determiner; N = Noun; AUX = Auxiliary; V = Verb; DEG = Degree Adverb; ADV = Adverb; P = Preposition

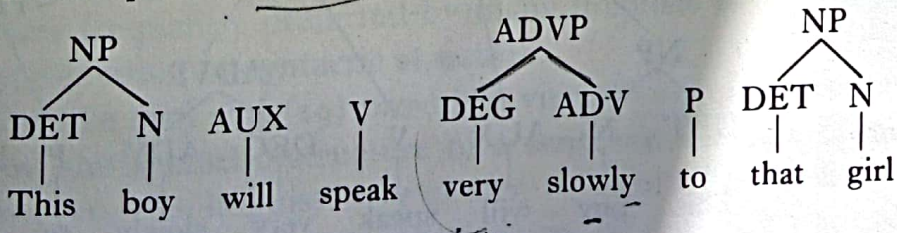
We can do this with the larger constituents as well: for instance, we'd want to say that *this boy* and *that girl* are constituents of the same type – phrases whose major constituent or *head* is a Noun in each case; hence we might label them *Noun Phrases* (NP):

(13)



Likewise, the phrase *very slowly* is a constituent of the same type as phrases like *rather quickly*, *somewhat rudely* – i.e. a phrase whose *head* (*slowly*, *quickly*, *rudely*) is in each case an Adverb, so we might label such phrases *Adverbial Phrases* (ADVP):

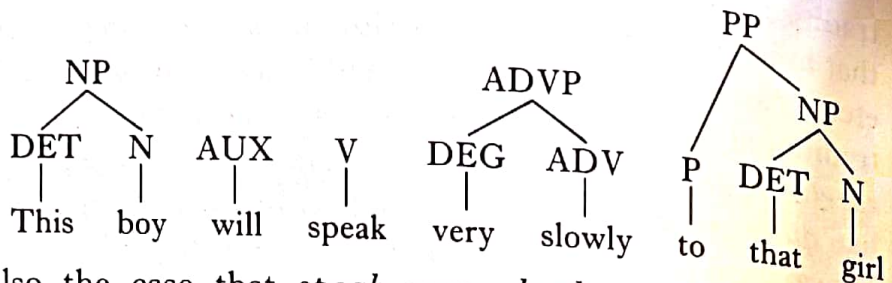
(14)



The phrase *to that girl* is a phrase of the same type as e.g. *from the headmaster*, *into the room*, *for Mary*, and in each case the head of the phrase is a Preposition (*to*, *from*, *into*, *for*), so we might call

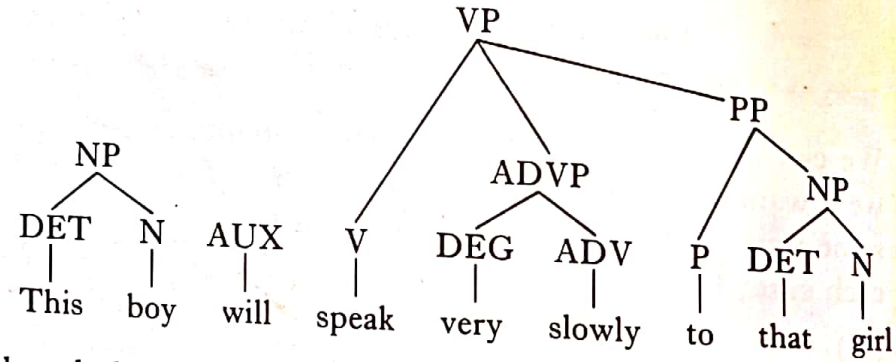
such phrases *Prepositional Phrases* (PP); accordingly, we can label *to that girl* as a Prepositional Phrase (PP):

(15)



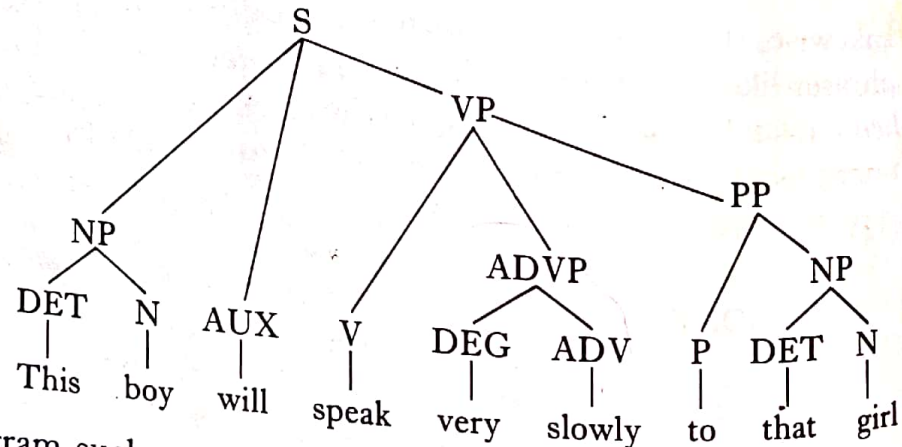
If it is also the case that *speak very slowly to that girl* is a constituent, then it appears to be a constituent of the same type as e.g. *give a present to Mary*, *run back home*, *close the door*, *die tomorrow* – i.e. a constituent whose head is a Verb, and which accordingly we might label Verb Phrase (VP):

(16)



Finally, the whole sequence *This boy will speak very slowly to that girl* is a constituent of the type we usually call a *Clause* or *Sentence* (S): this we can represent as follows:

(17)



A diagram such as (17) provides a visual representation of the hierarchical structuring of the words in (4) into *Constituents* (structural units): i.e. (17) provides a visual representation of the

Constituent Structure (or *Phrase Structure*) of the sentence (4). Hence, the type of diagram used in (17) is referred to as a *Phrase-Marker* (P-marker), because it marks the hierarchical grouping of words into phrases, and phrases into sentences. The P-marker (17) thus provides a visual representation of the superficial syntactic structure – or *Surface Structure*, as Chomsky calls it – of the sentence (4).

The method of representing syntactic structure visually by the use of tree-diagrams (P-markers) such as that in (17) is in fact only one of many alternative systems which have been devised in order to provide a visual representation of structure. Another (logically equivalent) method of visual display frequently used in the linguistic literature is to make use of *labelled brackets* rather than tree-diagrams. Within this alternative system we could represent the constituent status of each of the words in (4) as:

(18) [DET this] [N boy] [AUX will] [V speak] [DEG very] [ADV slowly] [P to] [DET that] [N girl]

Likewise, we could represent the fact that *this boy* and *that girl* are NPs (Noun Phrases), that *to that girl* is a PP (Prepositional Phrase), that *very slowly* is an ADVP (Adverbial Phrase), that *speak very slowly to that girl* is a VP (Verb Phrase), and that *This boy will speak very slowly to that girl* is an S (Clause) as follows:

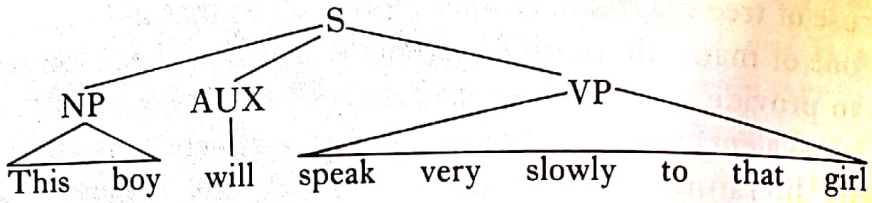
(19) [S [NP [DET this] [N boy]] [AUX will] [VP [V speak] [ADVP [DEG very] [ADV slowly]] [PP [P to] [NP [DET that] [N girl]]]]]

(By convention, only the left-hand member of any pair of brackets is usually labelled with the relevant category label.) The resultant diagram (19) is entirely equivalent to (17) – i.e. the two diagrams contain exactly the same information as each other. Generally speaking, tree-diagrams are easier to read, and this is the reason why they are frequently preferred by many linguists as a form of visual representation of syntactic structure.

Diagrams like (17) and (19) provide a virtually complete representation of the syntactic structure of a sentence like (4). Quite often, however, the linguist may prefer to give a less detailed account of the structure of a sentence, where he does not want to include absolutely every minute detail of the structure, but rather just wants to give a partial representation of the structure. For this reason, it is quite common to find in the relevant literature partial

tree-diagrams, or partial labelled bracketings. For example, suppose that, for the purposes of some argument that I am developing, it is essential to assume that a sentence like (4) contains three major constituents, the Noun Phrase *this boy*, an Auxiliary *will* and a Verb Phrase *speak very slowly to that girl* – but that it is irrelevant to my argument what the internal structure of the Noun Phrase and Verb Phrase may be. In such a case, in place of the tree diagram (17), I might prefer the partial P-marker (20):

(20)



(In partial P-markers like (20), it is quite common to use a 'triangle' to represent constituents with a complex internal structure that you don't choose to represent.) Or, in place of the detailed labelled bracketing (19), we might prefer the partial bracketing (21) below:

(21) [NP this boy] [AUX will] [VP speak very slowly to that girl]

(In what respect is (21) not quite *exactly* equivalent to (20)?) Generally speaking, linguists tend to use tree-diagrams (P-markers) for a full representation of the syntactic structure of a sentence (because at that level of detail, they are easier to read) and labelled bracketings for a partial representation of structure (because they occupy less space on the printed page). But recall that the two systems of representation are logically equivalent (whatever structure can be represented in the one system can be represented in the other, and vice-versa), so the question of whether you adopt one or the other is entirely a matter of typographical convenience, *not* a matter of any theoretical significance. Accordingly, we shall use both systems freely in our discussions here.

Earlier on, we said that the syntactic component of a grammar comprises a set of sentence-formation rules which have two tasks to fulfil: viz. (2) (i) and (ii) above; that is (i) specify which sequences of words form grammatical sentences in a language, and (ii) specify the internal syntactic structure of such sentences. We have now seen that the surface syntactic structure of a sentence can be represented in the form of a tree-diagram or P-marker like (17). Accordingly, we might reformulate the goal of the syntactic

component of a grammar as being that of generating (= specifying how to form) all the grammatical sentence-structures (surface structures) in a language. That is, we want to devise a set of rules which specify how sentences are built up out of phrases, and how phrases are built up out of words. If we further assume that surface structures can be adequately represented by P-markers such as (17), then the problem in effect reduces to devising a set of rules which will generate P-markers such as (17).

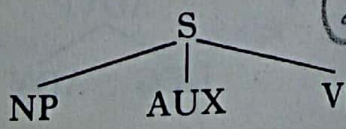
But what kind of rules could we devise which would generate tree-structures like (17)? One suggestion made by Chomsky is that structures such as (17) could be generated by a set of rules which he calls *Phrase Structure Rules* (or PS rules) – so called because they specify how sentences are structured out of phrases, and phrases out of words. Consider, for example, the following set of Phrase Structure Rules:

(22) (a) S → NP – AUX – VP
(b) VP → V – ADVP – PP
(c) ADVP → DEG – ADV
(d) PP → P – NP
(e) NP → DET – N

(S = Clause/Sentence; NP = Noun Phrase; AUX = Auxiliary; VP = Verb Phrase; V = Verb; ADVP = Adverbial Phrase; PP = Prepositional Phrase; DEG = Degree Adverb; ADV = Adverb; P = Preposition; DET = Determiner; N = Noun
→ = 'can consist of/can be formed from'
– = 'immediately preceding')

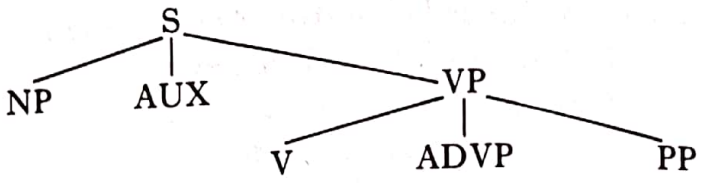
Given the gloss at the foot of (22), rule (22) (a) can be regarded as specifying 'You can form a Clause by taking a Noun Phrase immediately followed by an Auxiliary immediately followed by a Verb Phrase.' More formally, we can say that rule (22) (a) will *generate* the partial tree-structure (23) below:

(23)



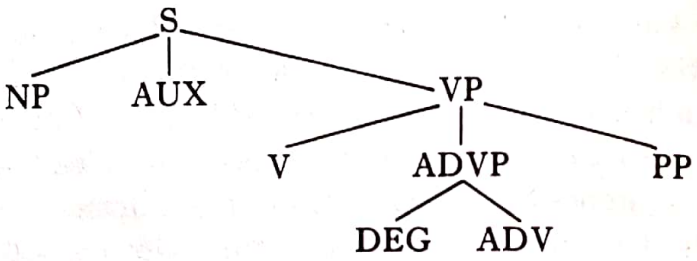
Rule (22) (b) specifies that we can form a Verb Phrase by taking a Verb immediately followed by an Adverbial Phrase immediately followed by a Prepositional Phrase: i.e. from (23) by application of rule (22) (b) we can generate:

(24)



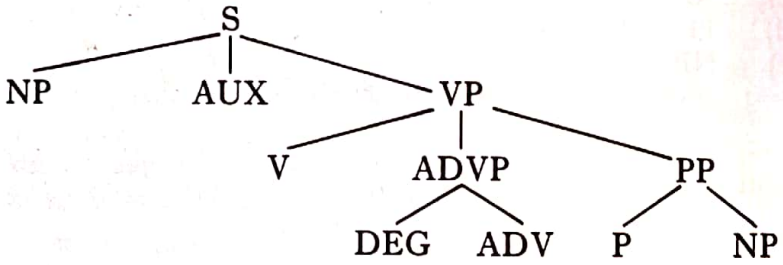
Rule (22) (c) specifies that we can form an Adverbial Phrase by taking a Degree Adverb followed by an Adverb; applying this rule to the structure (24), we expand (24) into:

(25)



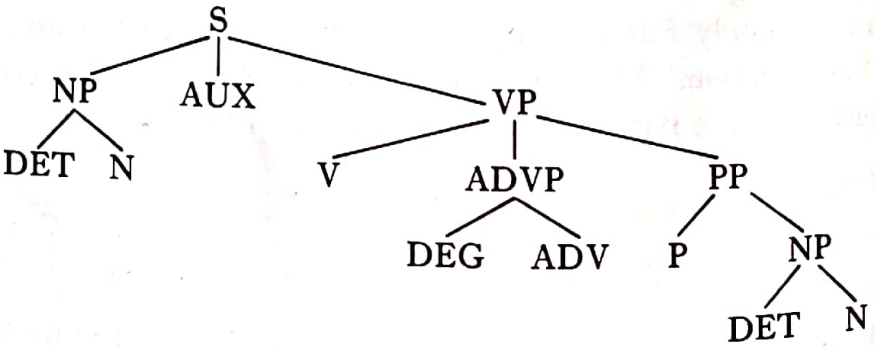
Rule (22) (d) specifies that we can form a Prepositional Phrase out of a Preposition immediately followed by a Noun Phrase; applying rule (22) (d) to the structure (25) will give us:

(26)



Rule (22) (e) says that we can form a Noun Phrase by taking a Determiner immediately followed by a Noun; if we apply this rule to expand both the Noun Phrases in (26), we *derive* the structure:

(27)



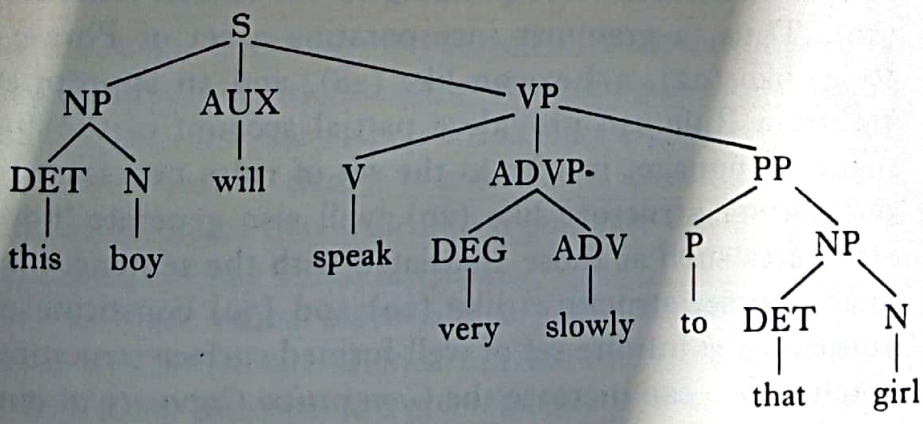
Let's now assume that in addition to the *Categorial Rules* (22) – i.e. rules expanding categories into other categories – the syntactic component of our grammar also contains a *Lexicon* (= dictionary),

or list of all the words in the language. And let us further assume that the *Lexical Entry* (= dictionary entry) for each such *Lexical Item* (= word) contains (in addition to other information) a specification of the syntactic category that the word belongs to. For present purposes, we might imagine that our Lexicon contains (inter alia) the following entries:

(28)
boy, N, . . .
girl, N, . . .
slowly, ADV, . . .
speak, V, . . .
that, DET, . . .
this, DET, . . .
to, P, . . .
very, DEG, . . .
will, AUX, . . .

And finally, let us also postulate a *Lexical Insertion Rule* by which any lexical item (= word) belonging to a given lexical category (i.e. word-category like N, V, P, ADV, etc. as opposed to *Phrasal Categories* like NP, VP, PP, ADVP, etc.) can be inserted in a structure like (27) under the corresponding category – e.g. any N (= Noun) can be inserted under N, any V (= Verb) under V, any ADV (= Adverb) under ADV, and so forth. Given such a Lexical Insertion Rule, we can insert e.g. *this* under the first DET in (27), *boy* under the first N, *will* under AUX, *speak* under V, *very* under DEG, *slowly* under ADV, *to* under P, *that* under the second DET, and *girl* under the second N, thereby deriving from (27) the Surface Structure (29):

(29)



Thus, we see that a set of Categorial Rules like (22) (which specify how categories are formed out of other categories), together with a

Lexicon like (28) and an associated Lexical Insertion Rule expanding lexical categories into Lexical Items ('real words'), will prove adequate to generate a surface structure such as (29), which is the same as (17) or (19). We have thus now achieved our aim of formulating a set of syntactic rules which will generate sentence-structures like (17).

But notice that our existing system of rules will generate not only the sentence-structure (29): the very same set of rules (together with the same Lexicon) can also be used to generate the surface structures associated with any of the following set of sentences:

(30)
This boy will speak very slowly to this girl
That boy will speak very slowly to that girl
That boy will speak very slowly to this girl
This boy will speak very slowly to this boy
This boy will speak very slowly to that boy
That boy will speak very slowly to this boy
That boy will speak very slowly to that boy
This girl will speak very slowly to this girl
This girl will speak very slowly to that girl
That girl will speak very slowly to that girl
That girl will speak very slowly to this girl
This girl will speak very slowly to this boy
This girl will speak very slowly to that boy
That girl will speak very slowly to that boy
That girl will speak very slowly to this boy

In other words, the simple grammar we have devised will generate not only the surface structure (29), but also fifteen other similar surface structures corresponding to the fifteen sentences listed in (30). Thus, a grammar incorporating a set of Phrase Structure Rules like (22), a Lexicon like (28), and an appropriate Lexical Insertion Rule can provide a partial account of the *creativity* of natural language, insofar as the set of rules necessary to generate one surface structure like (29), will also generate 'novel' surface structures such as those associated with the sentences in (30).

Of course, structures like (29) and (30) constitute only a tiny subset of the infinite set of well-formed surface structures found in English. We can increase the *Generative Capacity* of our grammar (= the set of structures that it generates) either by expanding the Lexicon on the one hand, or by expanding the Categorial Rules on the other. For example, we might add to our Lexicon Auxiliaries

such as *must*, *may*, *might*, *can*, etc., Nouns such as *man*, *woman*, *student*, *person*, *waiter*, etc., Determiners like *the* and *a*, Degree expressions like *rather*, *quite*, *too*, etc., Adverbs like *carefully*, *sincerely*, *thoughtfully*, etc., Verbs like *gesture*, *whisper*, *signal*, *talk*, etc. . . . and so on and so forth. In consequence, our grammar would then generate thousands of sentence-structures similar to (29), including those associated with sentences such as:

(31) This girl will speak very carefully to the waiter
A boy must speak very sincerely to a girl
That student may signal rather carefully to the waiter
Etc., etc.

Alternatively, we might modify or expand our existing categorial rules so that they generate more types of surface structure than before. Thus, for example, bearing in mind that the occurrence of the Adverbial Phrase in sentences like (30) is optional, so that alongside (30) we also find sentences such as:

(32) This boy will speak to that girl

we might propose to make the Adverbial Phrase an *optional* constituent of the Verb Phrase: this we could do by replacing rule (22) (b) by rule (33):

(33) $\underset{\sim}{VP} \rightarrow \underset{\sim}{V} - (\underset{\sim}{ADVP}) - \underset{\sim}{PP}$

where a constituent in parenthesis is, by convention, taken to be optional. Rule (33) is equivalent to the two rules (34) below:

(34) (a) $VP \rightarrow V - ADVP - PP$
(b) $VP \rightarrow V - PP$

Clearly, we need an enormous expansion of both our categorial rules and our Lexicon in order to achieve anything like an adequate grammar of English. But the main point that we are concerned with illustrating here is simply that it is possible to devise a system of sentence-formation rules that will indeed generate a wide range of surface structures for any given language.

Thus far, we have relied essentially on *intuition* to justify the postulation of an abstract hierarchical surface constituent structure associated with every sentence in a given language. But constituents and categories, in addition to having a basis in *intuition*, also have a rather different status – namely that of *theoretical constructs*: i.e. they are abstractions which we postulate in order to provide a

principled account of a number of linguistic facts which would otherwise remain unexplained. In what follows, we shall examine some of these facts in detail.

Perhaps the most important linguistic argument in favour of postulating that sentences are structured into constituents belonging to various categories is a *distributional* one. Syntax is essentially concerned with the distribution of words and phrases – i.e. specifying which words or phrases can appear in which positions in which types of sentence. Now, it turns out that any attempt to formulate a set of sentence-formation rules dealing with the distribution of words and phrases without using a set of syntactic categories encounters considerable difficulties, as we shall see.

One such problem is that any noncategorial grammar (i.e. a grammar which does not make use of categories) will miss important generalisations about significant regularities in the distribution of words and phrases. Consider, for example, the problem of generating a simple set of sentences like the following in a noncategorial grammar:

(35) (a) The noble king will introduce the rich count to the kind princess
(b) This wicked count may present that noble princess to a rich count
(c) The wicked princess can describe the rich king to the kind count
(d) That noble count must present a rich princess to the wicked king
(e) A wicked count may introduce a kind king to a rich princess

Now it might seem at first sight that we can directly generate sentences like those in (35) in a noncategorial grammar, simply by listing the set of words that can occur in first position, second position, third position, fourth position, and so forth, in the sentence: this we might do as follows:

(36)

1	2	3	4	5	6	7	8	9	10	11	12
the	noble	king	will	introduce	the	noble	king	to	the	noble	king
a	kind	count	may	present	a	wicked	count		a	wicked	count
this	rich	princ-	can	describe	this	kind	prin-		this	kind	princess
that	wicked	ess	must	...	that	rich	cess		that	rich	...
...	...	...	...		...	...	...		...	...	

We might then stipulate that we can form a grammatical sentence by taking any word from column 1, immediately followed by any

word from column 2, immediately followed by any word from column 3 . . . and so on and so forth. Any grammar incorporating a list like (36) would be noncategorial in the sense that it does not make use of syntactic categories, but rather simply of words. Could we not formulate an adequate syntax of a language like English using word-lists like (36)?

The answer to this question is that any noncategorial grammar suffers from a number of serious defects. One such drawback is that word-based grammars lack generality in the sense that they fail to capture important linguistic generalisations about the distribution of words. Notice, for example, that the set of words which can occur in column 1 is exactly the same as the set of words which can occur in columns 6 and 10. A list-based grammar like (36) makes this seem entirely coincidental, since each column represents a distinct sentence-position, and hence we might expect that each column will contain a different set of words, with no significant overlap between columns. But in fact, there clearly is significant overlap between the columns in three respects; firstly, columns (1), (6) and (10) contain the same set of words; secondly, columns (2), (7) and (11) contain the same set of words; and thirdly, columns (3), (8) and (12) contain the same set of words. The degree of overlap here is so great that we cannot dismiss these correspondences as coincidental – on the contrary, they clearly represent a significant distributional fact, namely that the same set of elements may occur in a variety of different sentence-positions. The function of grouping words into category-sets is precisely to capture such distributional generalisations, by assigning words which have essentially the same distribution to the same lexical category (= word-class), and then formulating our sentence-formation rules in terms of sequences of categories, rather than sequences of words. In the present case, for example, we achieve much greater generality by replacing the list (36) by a category-based rule like:

(37) S → *DET* – *A* – *N* – AUX – V – *DET* – *A* – *N* – P – *DET* – *A* – *N*

where DET is the category of Determiners (including *the*, *a*, *this*, *that*), A is the category of Adjectives (including *noble*, *wicked*, *kind*, *rich*) N is the category of Nouns (including *king*, *count*, *princess*), AUX is the category of Auxiliaries (including *will*, *may*,

can, *must*), V is the category of Verbs (including *introduce*, *present*, *describe*), and P is the category of Prepositions (including *to*, etc.).

But even rule (37) still misses at least one important distributional generalisation – namely that the sequence *DET – A – N* recurs in three separate sentence-positions (italicised in (37)) in the sentences (35) viz. immediately before AUX, immediately after V, and immediately after P. Clearly we are missing another obvious generalisation here, and rule (37) is unnecessarily cumbersome and repetitive in repeating the same sequence of categories (*DET – A – N*) three times. We can capture the relevant generalisation if we assume that the sequence *DET – A – N* in each case forms a larger phrasal category, a Noun Phrase (= NP): in which case, we can replace rule (37) by the more general set of rules (38) below:

(38) (a) S → NP – V – NP – P – NP
(b) NP → DET – A – N

Rule (38) can itself be made more general if we assume that the *P – NP* sequence together forms a PP, and that the V and the categories which follow it together form a VP; we shall discuss the motivation for positing VP and PP constituents later, so we shall not dwell on the matter here.

The essential motivation for setting up categories, and formulating sentence-formation rules in terms of categories should now be clear; namely that categories enable us to achieve much more general statements about distribution (i.e. much more general sentence-formation rules) than could be achieved by arbitrary lists of words like (36). Accordingly, we might define a category distributionally in the following terms:

(39) A *category* is a set of elements that have essentially the same distribution, and that recur as a structural unit in a variety of different sentence-positions and sentence-types

Thus far, we have argued that a category-based syntax achieves a greater level of generality than a word-based syntax. But, in fact, we can go further than this, and demonstrate that it is doubtful that word-based syntaxes can even achieve *observational adequacy* (at least in terms of a finite set of rules or lists). For natural languages typically have the property that they allow (potentially infinite)

recursion or *iteration* of categories – a process which can easily be handled in a category-based grammar, but cannot be handled in any finite way in terms of a grammar using word-lists. To illustrate the problem, consider how we might generate a set of sentences such as the following:

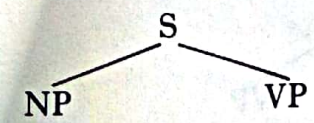
(40) (a) John knows Joe
(b) Fred knows John knows Joe
(c) Jim knows Fred knows John knows Joe
(d) Pete knows Jim knows Fred knows John knows Joe

Any attempt to write a word-based set of sentence-formation rules to generate sentences like (40) faces the problem that there is no upper limit to the (potential) length of such sentences: hence, any set of rules which attempts to simply list the set of possible word-combinations in such cases will have to be *infinite*. But this violates the most fundamental criterion of adequacy imposed on grammars – namely that they contain a *finite* system of rules capable of generating a potentially infinite set of sentences. By contrast, in a category-based grammar, we can generate an infinite set of sentences like (40) in terms of a very simple *recursive* set of rules including:

(41) (a) $S \rightarrow NP - VP$
(b) $VP \rightarrow V - \begin{cases} NP \\ S \end{cases}$
(c) $NP \rightarrow N$

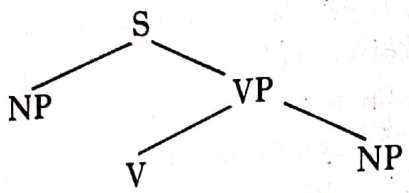
where (41) (a) specifies that we can form a Clause (= S) out of a Noun Phrase immediately followed by a Verb Phrase, (41) (b) specifies that we can form a Verb Phrase by taking a Verb immediately followed by a Noun Phrase or a Clause, and rule (41) (c) says that we can form a Noun Phrase out of a Noun on its own (i.e. a Noun like *John*, *Joe*, *Fred*, *Jim*, etc.). By applying rule (41) (a), we generate the structure:

(42)



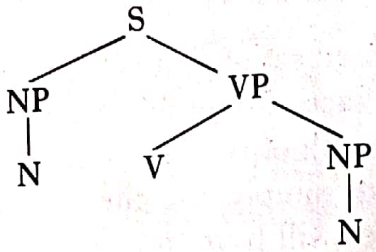
Rule (41) (b) tells us that we can expand the VP in (42) into a V followed by either an NP, or an S. If we choose the former option and expand VP into the sequence V – NP, we obtain:

(43)



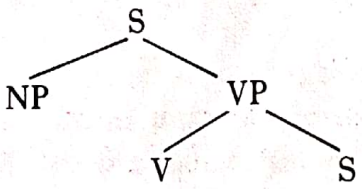
Subsequent application of rule (41) (c) to both NPs in (43) will then yield:

(44)



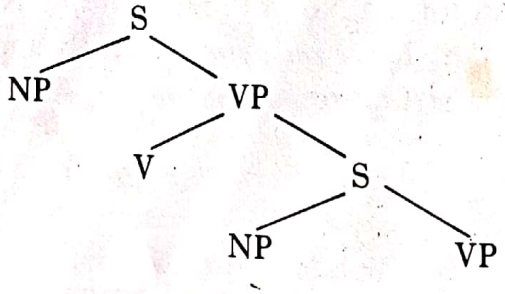
and (44) is precisely the surface structure of sentences like (40) (a), *John knows Joe*. Alternatively, if instead we take the second option in rule (41) (b) and expand the VP in (42) into the sequence $V-S$, we derive:

(45)



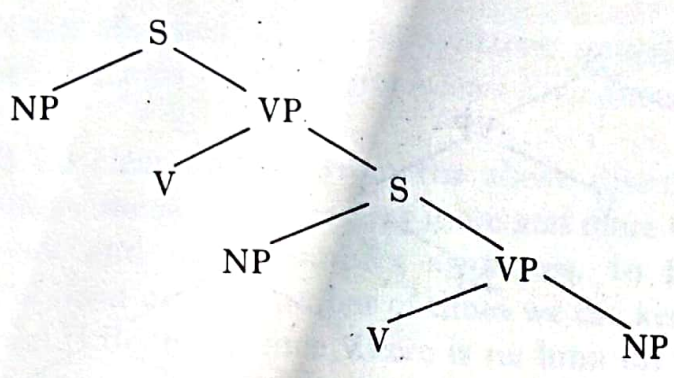
If we now reapply rule (41) (a) to expand the embedded (= lower) S in (45) into $NP-VP$, we derive:

(46)



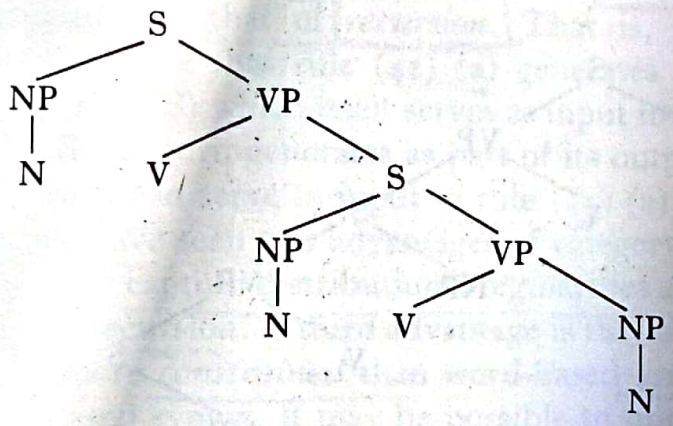
If we now expand the embedded (= lower) VP in (46) into $V-NP$ by rule (41) (b), we obtain:

(47)



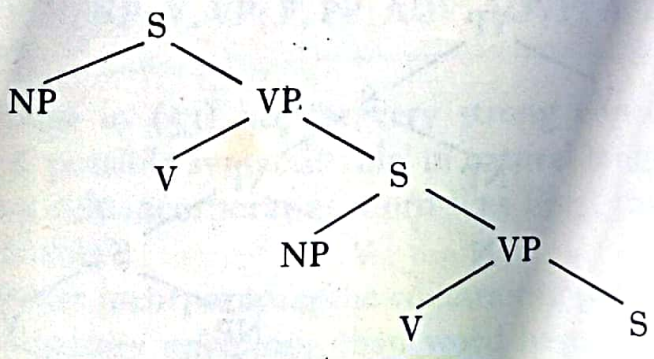
If we then further expand all the NPs in (47) into N by rule (41) (c), we get:

(48)



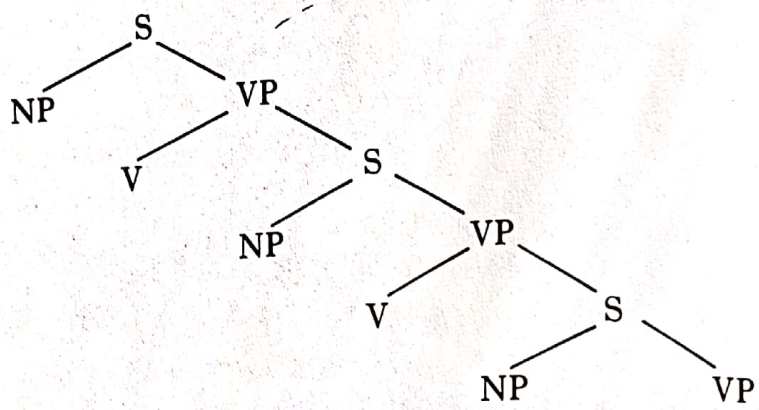
i.e. precisely the abstract structure associated with sentence like (40) (b), *Fred knows John knows Joe*. But now suppose that instead of expanding VP in (46) into *V – NP*, we expand it into *V – S* by rule (41) (b) instead: this would give us:

(49)



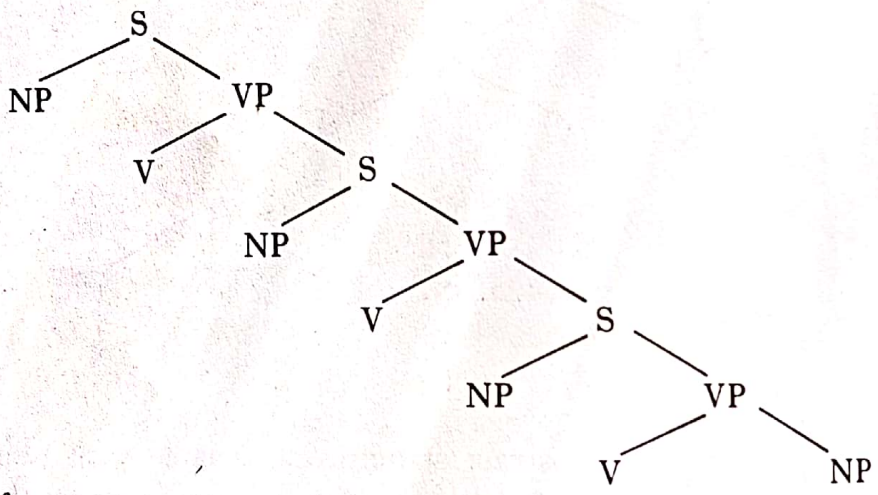
If we now expand the most deeply embedded (= lowest) S in (49) into *NP – VP* by applying rule (41) (a) once again, we obtain:

(50)



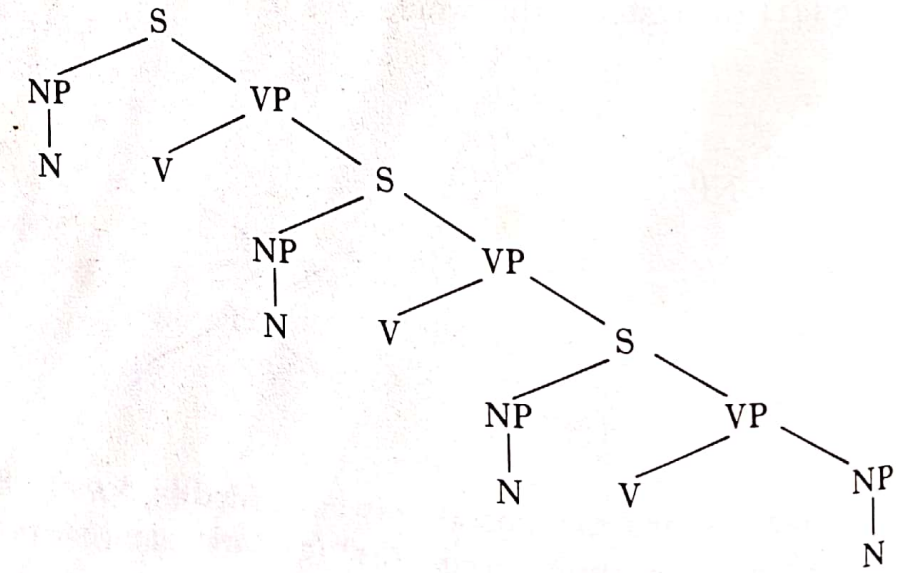
And if we then apply rule (41) (b) to expand the most deeply embedded VP in (50) into the sequence $V - NP$ by rule (41) (b), we derive:

(51)



Finally, if we now apply rule (41) (c) to expand all occurrences of NP in (51) into N, we obtain the structure:

(52)



and (52) is the abstract superficial syntactic structure associated with sentences such as (40) (c), *Jim knows Fred knows John knows Joe*.

It should be clear enough from the above discussion that by reapplying the same set of rules (41) more and more times, we can generate more and more complex sentences. In fact, there is potentially no limit on the number of times we can keep reapplying the rules; and, in consequence, there is no limit on the length or number of such sentences that we can generate. In other words, the rules (41) will generate an infinite set of abstract sentence-structures. The interesting property that the rule-system (41) has which enables a finite set of rules to generate an infinite set of sentence-structures is that of *recursion*. That is, the rules are recursive in the sense that rule (41) (a) generates as part of its output a category (VP) which itself serves as input to rule (41) (b); and rule (41) (b) in turn generates as part of its output a category (S) which in turn can serve as input to rule (41) (a).

Thus far, we have seen two advantages of category-based grammars: firstly, they capture distributional regularities and, secondly, they can handle recursion. A third advantage is that category-based grammars are more *constrained* than word-based grammars. For, in a category-based syntax, it may be possible to impose two very strong constraints on the nature of all sentence-formation rules in natural language: viz.

(53) (i) All syntactic rules in all natural languages are category-based (or, in Chomsky's terminology, *structure-dependent*)

(ii) The set of lexical and phrasal categories found in any language is drawn from a highly restricted finite universal set including S; N, NP; V, VP; P, PP; ADV, ADVP; A, AP; AUX; DET; etc.

The conditions in (53) impose very strong constraints on what constitutes a 'possible syntactic rule' in natural languages: e.g. (52) rules out any rule incorporating word-lists like (36) as an 'impossible syntactic rule'.

Any grammar incorporating the constraints (53) can also achieve greater *explanatory adequacy* than word-based grammars: i.e. it offers a more plausible model of language acquisition. If our linguistic theory imposes the condition that all grammars of all natural languages are subject to the constraints (53), then the task

facing the child learning a language is a relatively simple one: i.e. the child has to identify which words and phrases belong to which categories in the language he is learning, and which categories can occur in which sentence-positions. For example, if a child learns that in English the words *a*, *the*, *this*, *that*, *my*, *your*, *his*, etc. all belong to the category DET (= Determiner), and if he hears a sentence like:

(54) I want *a* toy

then, given the constraint that all syntactic rules are category-based, he can immediately infer that not only *a* but also all other members of the same category (DET) can occur in the italicised position – i.e., having heard (54), he will be able to infer that the sentences in (55) below are also grammatical in English:

(55) (a) I want *the* toy
(b) I want *this* toy
(c) I want *that* toy
(d) I want *my* toy
(e) I want *your* toy
(f) I want *his* toy
Etc.

Furthermore, given the same assumption that all syntactic rules are category-based (or *structure-dependent*), he can also infer that in place of *toy* in (54) he can substitute any other item belonging to the same category (N, = Noun), and thus generate e.g.:

(56) (a) I want a *ball*
(b) I want a *television*
(c) I want a *blackboard*
(d) I want a *banana*
Etc.

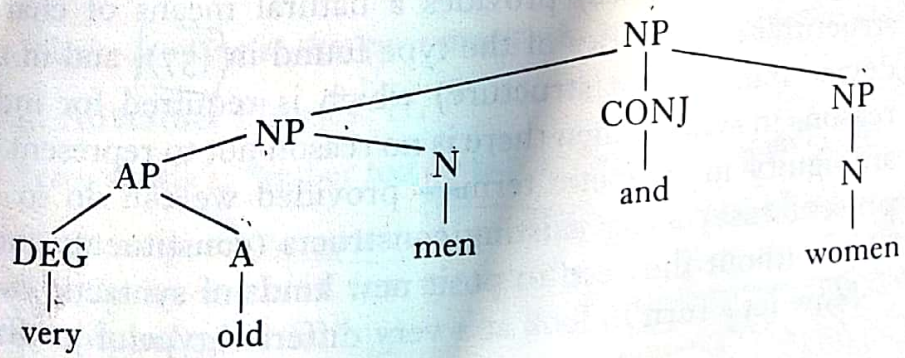
In short, the twin assumptions that syntactic rules are category-based, and that there are a highly restricted finite universal set of categories in natural language, together with the assumption that the child either *knows* (innately) or *learns* these constraints (53), provide a highly plausible model of language acquisition, in which languages become learnable in a relatively short, finite period of time (a few years).

Another, very different reason for assuming that sentences have a hierarchical constituent structure concerns the fact that such an assumption makes it possible to provide a principled account of certain types of *ambiguity* characteristic of natural languages. Here, it is important to distinguish between two very different kinds of ambiguity: (i) *lexical* ambiguity, and (ii) *structural* ambiguity. Lexical ambiguity is ambiguity attributable to the fact that some particular lexical item (= word) has more than one meaning. For example, the word *ball* is ambiguous as between one sense in which it means a 'round object', and a second sense in which it means a 'dance'; the ambiguity here is purely lexical. But there is a second type of ambiguity characteristic of natural languages, illustrated by the phrase:

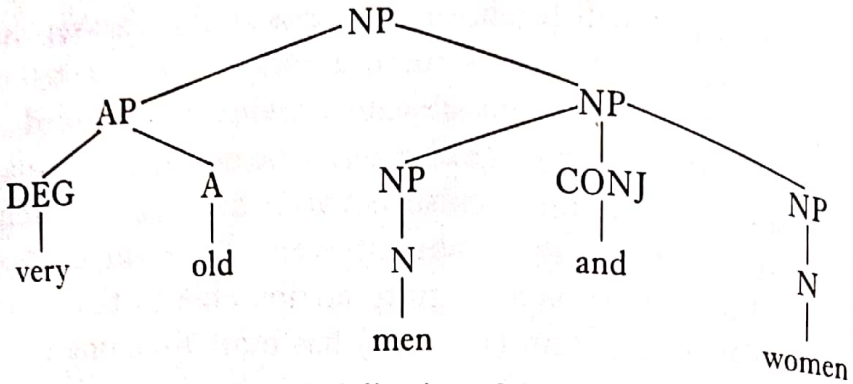
(57) very old men and women

Clearly, (57) is ambiguous, but the ambiguity does not lie in the words themselves: i.e. it isn't the case that *old*, or *men*, or *women* has more than one distinct sense. Rather, the ambiguity rests on whether *very old* is taken as qualifying only *men* (so that (57) has the sense of 'women and very old men') or as qualifying the phrase *men and women* (so that (57) means 'very old men and very old women'). Thus, it would appear that the ambiguity is not lexical in nature, but rather *structural*, insofar as it resides in the question of which part of the structure of (57) is modified by *very old*. Hence a natural way of representing the ambiguity would be to say that (57) has two distinct constituent structures: if *very old* is taken as qualifying only *men*, then (57) will have the structure (58) below; but if *very old* qualifies the phrase *men and women* then (57) will have the structure (59):

(58)



(59)



AP = Adjectival Phrase; A = Adjective; CONJ = Conjunction

Against this, it might be objected that in a model of language where Syntax is treated as autonomous of Semantics, it is not the task of a *syntactic* theory to answer questions like 'Is such-and-such a sentence structurally ambiguous, and if so how can its ambiguity be formally represented?' Ambiguity, we might object, is a *semantic* property, and hence falls within the scope of a *semantic* theory, not a syntactic one. Chomsky's reply to this type of objection would be the following:

(60) The phenomena presented to us do not, of course, come provided with a system of appropriate categories or explanatory principles. It is only in the light of a particular theory that we can draw conclusions as to how some phenomenon is to be interpreted. . . It is an obvious and uncontroversial fact that informant judgements and other data do not fall neatly into clear categories: syntactic, semantic, etc.

(Chomsky, *Essays* (1977), p. 4)

What Chomsky is saying here is that the question of whether we decide to treat a particular phenomenon as syntactic or semantic should not be decided on the basis of private prejudices, but rather in terms of the overall organisation of a linguistic theory. If – as in the present case – Syntax (by means of the constituent structure it assigns to sentences) provides a natural means of characterising structural ambiguities of the type found in (57), and in terms of a device (constituent structure) which is required for independent reasons in syntax, then there is no reason not to represent structural ambiguity in syntactic terms – provided we can do so (as in the present case) using existing constructs (constituents and categories), without the need to posit new kinds of syntactic constructs.

Now let's turn to look at a very different type of justification for

positing that sentences are hierarchically structured into constituents assigned to various categories: this time we shall argue that categories have independent *morphological* motivation. In English, Verbs take a characteristic range of inflections including *-ing*, *-s*, *-ed*, giving us paradigms like:

(61) like – liking – likes – liked
kiss – kissing – kisses – kissed
smack – smacking – smacks – smacked
float – floating – floats – floated
etc.

By contrast, Prepositions do not permit the same range of verbal inflections: cf.

(62) at – *atting – *ats – *atted

In much the same way, only (a subset of) Adjectives have a comparative form in *-er*, cf.

(63) tall – taller; fat – fatter; lovely – lovelier; etc.

and not e.g. Nouns: cf.

(64) boy – *boyer; girl – *girler; cat – *catter; etc.

Conversely, only Nouns – not Adjectives – have a plural inflection (usually *-s*): hence the contrast in:

(65) They are fools/*foolishes

In much the same way only Pronouns are inflected for *nominative* and *accusative case* (in traditional Latin terminology), giving rise to alternations like:

(66) I – me; he – him; she – her; we – us; they – them; etc.

whereas Nouns, by contrast are not morphologically marked this way. Finally, only Noun Phrases can take a possessive-*'s* inflection, as in:

(67) John's; the king's; that poor man's; the king of England's; etc.

and not e.g. Adverbial Phrases: cf.

(68) *very slowly's; *rather too quickly's; *much too soon's; etc.

Thus, we need to posit *categories* (i.e. different types of constituents) not only to account for syntactic facts, but equally to account for morphological facts as well.

Just as constituents and categories prove essential constructs for any model of syntax and morphology in natural languages, so too they also prove essential prerequisites for any adequate description of the phonology of natural language sentences. Consider, for example, the problem of formulating a phonological rule for English which will provide a principled account of word-stress in cases such as the following (where stress is indicated by italics):

(69) (a) I really must pro*test* about it
(b) Why make a *pro*test about it?

(70) (a) I don't want to con*test* your claim
(b) I don't think it was a fair *con*test

(71) (a) I wouldn't re*ject* him outright
(b) This one is a *re*ject

Notice that in each of the (a) sentences, the stress falls on the second syllable (italicised) of the relevant word; whereas in each of the (b) sentences, the stress falls on the first syllable. Why should this be? An obvious answer is that in each case the relevant word (*protest*, *contest*, *reject*) has the categorial status of a *Verb* in the (a) sentences, but the categorial status of a *Noun* in the (b) sentences. That is, the relevant generalisation is that words like *protest* carry stress on the second syllable when used as verbs, but on the first syllable when used as nouns. But any such generalisation presupposes that phonological rules have access to categorial information: i.e. that such rules have to know what the category of a constituent is before they can apply to it.

As a second example of how constituent structure determines pronunciation, consider the contrast between the following two examples, where italics are used to indicate (primary) stress:

(72) (a) *black*bird (a species of bird, like *thrush*, *robin*, etc.)
(b) *black bird* (a bird which is black, as opposed to a *white bird*)

The different stress patterns here appear to correlate with a difference in constituent structure: in (72) (a) the sequence *blackbird* represents a single Noun, whereas in (72) (b) it represents an *A – N* (Adjective – Noun) sequence. Overall, then, there seems little doubt that constituent structure has phonological, as well as syntactic and morphological motivation.

Let's move on to look at a further (syntactic) phenomenon which lends support to the postulation of constituents and categories –

namely the phenomenon of *coordination*. English and other languages have a variety of *coordinating conjunctions* (CONJ) which can be used to *conjoin* (or *coordinate*) words or phrases: cf.

(73) (a) He has *a cat* and *a dog*
(b) I met *John* and *Mary*
(c) Do you know *the man next door* and *his girlfriend*?
(d) It was raining *yesterday* and *the day before*

In each of the sentences in (73) *and* has been used to conjoin the italicised pairs of words or phrases. Clearly, any observationally adequate grammar of English will have to provide a principled answer to the question:

(74) What kind of elements can and cannot be conjoined (or coordinated) in English?

Now, it turns out that we can't just coordinate any random pair of elements in English, as we see from the ungrammaticality of:

(75) *John rang *up his mother* and *up his sister*

Why can the italicised items be conjoined in (73), but not in (75)? One possible answer could be that the italicised elements can be conjoined in (73) because they are constituents, whereas the coordinate sequences in (75) are not constituents. That is, we might suggest a constraint along the lines of:

(76) Only constituents can be conjoined; nonconstituent sequences cannot be conjoined

But can a constituent of one type (or category) be coordinated with a constituent of another type? Consider the following paradigm:

(77) (a) John wrote *to Mary* and *to Fred* (= PP and PP)
(b) John wrote *a letter* and *a postcard* (= NP and NP)
(c) ?John wrote *a letter* and *to Fred* (= NP and PP)
(d) ?John wrote *to Fred* and *a letter* (= PP and NP)

(? in front of a sentence means that it is 'marginal' – i.e. of doubtful well-formedness, hence unidiomatic and unnatural.) (77) shows us that we can conjoin two PPs or two NPs quite freely, but that any attempt to conjoin an NP with a PP, or a PP with an NP leads to an unnatural, unidiomatic and 'forced' sentence. This suggests that we might revise our constraint (76) as:

(78) Only identical categories can be conjoined, idiomatically

We can now test the predictions made by the constraint (78) for a wider range of categories: it predicts that the following sentences will all be grammatical, because the conjoined (italicised) pairs of elements belong to the same category:

(79) (a) Good *linguists* and *philosophers* are rare (N and N)
(b) John is a very *kind* and *considerate* person (A and A)
(c) There are arguments *for* and *against* this claim (P and P)
(d) J.R. *walks* and *talks* like a true Texan (V and V)
(e) You can bring *these* and *those* books (DET and DET)
(f) He opened the door quite *slowly* and *deliberately* (ADV and ADV)

In each case in (79) we have conjoined identical *lexical* categories; but the constraint (78) also predicts that we should be able to conjoin identical *phrasal* categories as well. And – as the sentences (80) below indicate – this prediction seems to be correct:

(80) (a) *The man next door* and *his wife* are nice (NP and NP)
(b) He is a *very shy* and *rather inarticulate* person (AP and AP)
(c) He went *to London* and *to Paris* (PP and PP)
(d) He may *go to London* and *visit his mother* (VP and VP)
(e) John drives *very slowly* and *very carefully* (ADVP and ADVP)

It thus seems that the principle (78) has considerable empirical support. But note that the principle makes crucial reference to constituent structure and category membership: in other words, it is not clear how we could provide any principled account of coordination if we did not posit that sentences are structured into sets of *constituents*, each of which belongs to a particular *category*. This discussion serves to illustrate our earlier remark that constituents and categories have the status of *theoretical constructs* – i.e. elements without which it is not obvious how we could provide a principled explanation of linguistic phenomena such as coordination.

Let's now turn to look at another linguistic phenomenon whose systematic description also seems to require the postulation of an abstract constituent structure associated with sentences – and this is the phenomenon we shall call *intrusion*. Not infrequently,

speakers may insert some parenthetical expression like 'if you ask me', 'I suspect', 'in all probability', 'almost certainly', 'quite obviously', etc. somewhere internally within a sentence. But such elements cannot be freely inserted anywhere in a sentence, as we see from (81):

(81) (a) *The, almost certainly, cat will eat his dinner
(b) The cat, almost certainly, will eat his dinner
(c) The cat will, almost certainly, eat his dinner
(d) ?The cat will eat, almost certainly, his dinner
(e) *The cat will eat his, almost certainly, dinner

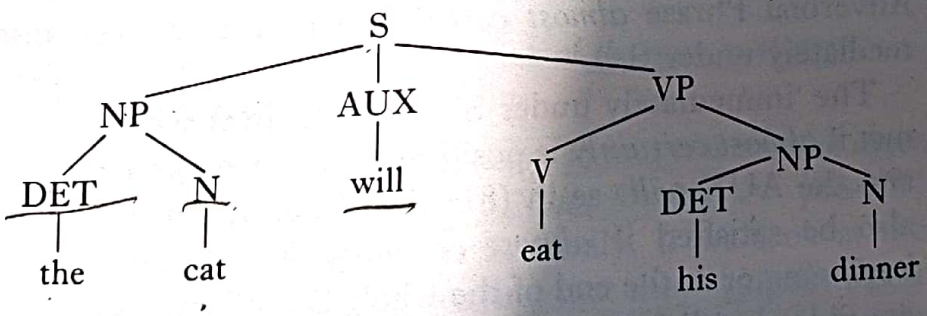
That is, an Adverbial Phrase like *almost certainly* can intrude between certain sequences of words, but not between others. How can we account for this fact?

Once again, if we assume that sentences are hierarchically structured into constituents assigned to a restricted set of categories, we can perhaps begin to gain some insight into what might be going on. Suppose we posit, for example, that a sentence like:

(82) The cat will eat his dinner

has the constituent structure:

(83)

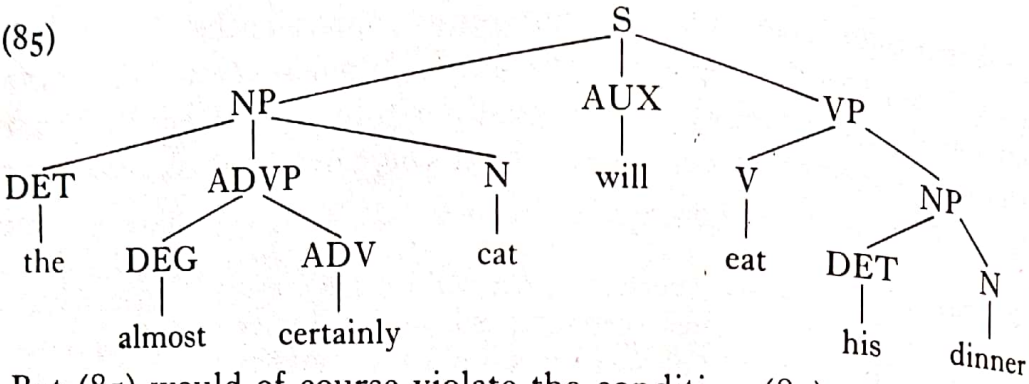


And suppose we further postulate the following condition on the distribution of parenthetical adverbial expressions like *almost certainly*:

(84) Parenthetical adverbial expressions like *almost certainly* can be inserted only immediately under an S, not a VP, or NP, or PP, etc.

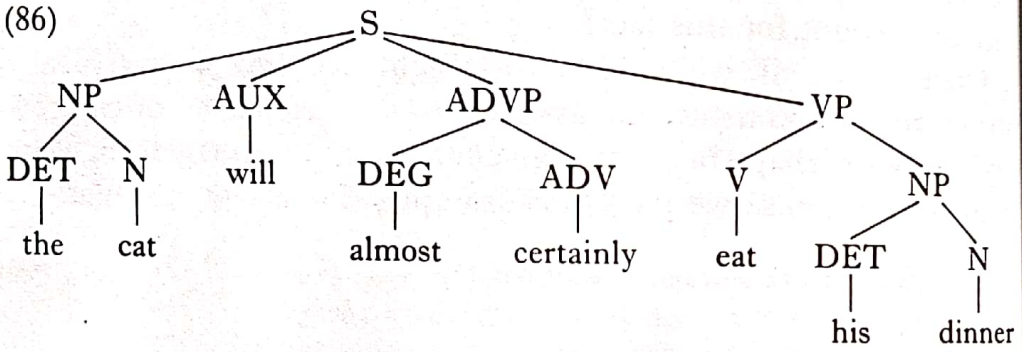
We can now provide a principled account of the contrast between e.g. (81) (a) and (81) (c); for (81) (a) would have the structure:

(85)



But (85) would of course violate the condition (84), since in (85) the Adverbial Phrase has been inserted immediately under an NP – in spite of the fact that (84) only allows parenthetical adverbials to be inserted immediately under an S. By contrast, (81) (c) would have the structure:

(86)



and (86) does indeed satisfy the condition (84), since in (86) the Adverbial Phrase *almost certainly* has indeed been inserted immediately under S.

The 'immediately under S' condition (84) will of course also be met if *almost certainly* is positioned between the subject NP *the cat* and the AUX *will*, as in (81) (b). In addition, the condition will also be satisfied if *almost certainly* is positioned either at the beginning or at the end of the whole S; and the resultant sentences are indeed well-formed:

(87) (a) Almost certainly, the cat will eat his dinner
(b) The cat will eat his dinner, almost certainly

Thus, condition (84) seems to have a fair amount of empirical support.

So we find that yet a further phenomenon – that of the intrusion of certain types of phrase in various positions internally within a sentence – cannot be accounted for adequately unless we posit that sentences are hierarchically structured into constituents and cate-

gories. Now we shall go on and show that this is also true of a further phenomenon characteristic of natural languages – the phenomenon of *anaphora*.

It is a general property of natural languages that they possess *anaphoric devices* – i.e. devices for referring to entities mentioned elsewhere in the same sentence or discourse. Consider the following dialogue:

(88) SPEAKER A: What do you think of Fred?
SPEAKER B: I can't stand *the bastard*

In (88) the italicised phrase is an anaphoric expression whose *antecedent* is *Fred* (i.e. *the bastard* refers back to *Fred*). In addition to anaphoric expressions like *the bastard*, *the fool*, *the idiot*, etc., natural languages typically possess another type of *anaphor* termed *anaphoric pronouns* in traditional grammars. One such anaphoric pronoun in English is *him*; this we could have used instead of *the bastard* in (88):

(89) SPEAKER A: What do you think of Fred?
SPEAKER B: I can't stand *him*

However, the term *pronoun* is peculiarly inappropriate here, for two reasons. Firstly, it is by no means the case that the antecedent of a word like *him* is invariably a *Noun*: for example, in a discourse such as:

(90) SPEAKER A: What do you think of *the man next door*?
SPEAKER B: I can't stand him

the antecedent of *him* is *the man next door*, so that it would be more appropriate to describe *him* as a *pro-Noun-Phrase* (= pro-NP) rather than as a *pro-Noun* (pro-N). Secondly, if we look at the distribution of so-called *pronouns*, we find that they typically occur in the sentence-positions which Noun Phrases can occupy, not in the sentence-positions which Nouns can occupy. Thus, in a sentence like (91) (a), we can replace the whole Noun Phrase *the woman in the blue hat*, but not the Noun *woman*, by the corresponding pronoun *her*: cf.

(91) (a) I like the woman in the blue hat
(b) I like her
(c) *I like the her in the blue hat

Thus, the term *pronoun* is doubly inappropriate, since it is not an

accurate description either of the distribution of such items, or of the class of expressions which can serve as their antecedents. Words like *him*, *her*, etc. are more accurately described as *pro-NPs*, since they occur in NP-positions in a sentence, and generally have NPs as their antecedents. Not all *pro-constituents* are pro-NPs, however. One might argue, for example, that in a discourse like:

(92) SPEAKER A: Have you ever been to Paris?
SPEAKER B: No, I have never been *there*

the word *there* is a *pro-PP* (pro-Prepositional-Phrase), in that it has as its antecedent, and occurs in the same sentence-position as the Prepositional Phrase *to Paris*.

Any adequate description of pro-constituents (or *proforms*) will have to be concerned with both the syntax and semantics of them. Any adequate syntax of proforms will have to specify which sentence-positions particular proforms can occur in; while any adequate account of the semantics of proforms will have to specify what kind of expressions can be construed as the antecedent of a given proform. But it turns out that any adequate description of either the syntax or the semantics of proforms will have to make crucial reference to *constituents* and *categories*.

We can make this discussion more concrete in relation to the proform *it*. An adequate syntax for *it* will have to answer the question 'What range of sentence-positions can *it* occupy in English?' The answer is that *it* can occupy the same range of sentence-positions as a typical Noun Phrase like *the book on the table*, as we see from (93):

(93) (a) { The book on the table / It } is interesting
(b) Is { the book on the table / it } yours?
(c) I like { the book on the table / it }
(d) I've read about { the book on the table / it }

Syntactically, then, *it* has the same distribution as a typical Noun Phrase: i.e. syntactically, it functions like a pro-NP.

But what about the semantics of *it*? What kind of expression can be interpreted as the antecedent of *it*? All the italicised expressions in (94) can be interpreted as possible antecedents for *it*:

(94) (a) *My car* is OK when it works
(b) *The back seat of my car* has got books on it
(c) The trouble with *the table* is that it's too small
(d) If I find *the lid of the kettle*, I'll give it to you
(e) I never use *that bone-handled knife*, because it's blunt

What have the italicised expressions in (94) got in common? The obvious answer is that they are all Noun Phrases, since they can all occur in the (bracketed) NP-positions in (93). Thus, an obvious generalisation about the semantics of *it* is that *it* can be interpreted as having an NP as its antecedent.

But is it only Noun Phrases which can serve as the antecedent of *it*? Data like (95) cast doubt on this:

(95) (a) SPEAKER A: *Mary has finished her assignment*
SPEAKER B: I don't believe it
(b) *Jean is pregnant again*, I just know it
(c) If *I don't turn up*, it won't be fair on you
(d) SPEAKER A: *Is there snow outside?*
SPEAKER B: Does it matter?
(e) They say *he's planning to give up his job*, but it may not be true

Each of the italicised phrases in (95) can serve as the antecedent of *it*, and each appears to have the categorial status of an S (= Clause). So it would appear that not only an NP, but also an S can be interpreted as the antecedent of the proform *it*.

This shows up an important discrepancy between the syntax and semantics of certain types of proform: syntactically, *it* occurs only in typical NP-positions, not in typical S-positions. Thus, for example, a verb like *hope* can take a following S-complement, but not a following NP-complement:

(96) (a) I hope *you will come* (= *hope* – S)
(b) *I hope *the pen on the table* (= *hope* – NP)

Significantly, *it* cannot be used as a direct complement of *hope*:

(96) (c) *I hope it

This shows us that *it* cannot occur in a typical S-position in a sentence; on the contrary, syntactically *it* occurs only in NP-positions; but semantically, *it* can have as its antecedent either an NP, or an S.

Thus, any adequate description of proforms must include both a syntactic and a semantic characterisation of their function. It's not much use simply specifying that such-and-such a form is a pro-NP,

pro-VP, or pro-S: is that meant to be a description of its syntactic distribution, or of the class of expressions which can serve as its antecedent, or both?

The conclusion to be drawn from the discussion of proforms here is that any adequate account of either the syntax or the semantics of pro-constituents will have to make crucial reference to structural properties of sentences. For it turns out that proforms have the same syntactic distribution as certain categories on the one hand, and that the class of expressions which can serve as their antecedents is most simply characterised in categorial terms on the other. Once again, then, we find a linguistic phenomenon which cannot adequately be described without appealing to notions of constituent structure.

Now let's turn to a further linguistic phenomenon which supports the same conclusion. Under certain discourse-conditions, it is possible in English (and other languages) to omit some sentence-fragment identical to one which occurs elsewhere in the same sentence or discourse: for example, in a discourse such as (97), it is possible to omit the slashed material, where it is identical to the italicised material:

(97) SPEAKER A: John won't *wash the dishes*
SPEAKER B: I bet he will ~~wash the dishes~~ if you're nice to him

and again in (98):

(98) John won't *help me with the dishes*, but Paul will ~~help me with the dishes~~

An obvious question which any observationally adequate grammar of English is going to have to answer is:

(99) What kind of elements can be omitted in this way, and under what conditions?

In actual fact, we can't just omit *any* random set of words in a sentence when they are identical to another set, as we see from the fact that the following sentences are ungrammatical if the slashed material is omitted:

(100) (a) *John won't put the car in the *garage*, but Paul will put the car in the ~~garage~~
(b) *John won't put the car *in the garage*, but Paul will put the car ~~in the garage~~

(c) *John won't put the *car in the garage*, but Paul will put the ~~car~~ ~~in the garage~~

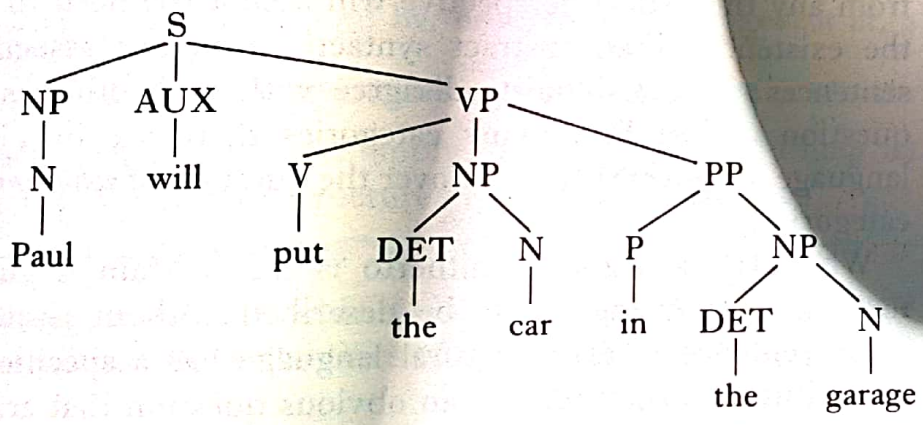
(d) *John won't put *the car in the garage*, but Paul will put ~~the car~~ ~~in the garage~~

Although we can't omit any of the slashed sequences in (100) above, we can delete that in (101) below:

(101) John won't *put the car in the garage*, but Paul will ~~put the car~~ ~~in the garage~~

Why is it that the slashed material can be omitted in (101), but not in (100)? It appears that we can only give a principled answer to this question in terms of constituent structure. Consider the structure of a sentence such as *Paul will put the car in the garage*: this is

(102)



Given the assumption of a constituent structure such as (102) above, we can suggest as a tentative answer to the question we asked earlier that:

(103) Only Verb Phrases (VPs) can be omitted, if they are identical to some other VP in the same discourse

Principle (103) would provide a ready account of why omission of the slashed material was possible in (101), but not in (100); for in (101) the slashed material was a VP, whereas in (100) (a) it was an N (= Noun), in (100) (b) it was a PP (= Prepositional Phrase), in (100) (c) it was an N – PP sequence, and in (100) (d) it was an NP – PP sequence. Confirmation of the validity of (103) comes from the fact that it correctly predicts that the slashed VPs in (104) below can be omitted if they are identical to the italicised VPs:

(104) (a) He may *come home early*, but then again, he may not ~~come home early~~

(b) Mary wants to *close the shop*, but I don't want to ~~close the shop~~
(c) *Fetch me an apple*, if you can ~~fetch me an apple~~
(d) SPEAKER A: Could you *have a look at the car*?
SPEAKER B: OK, I will ~~have a look at the car~~.

What's interesting about the above discussion is that it tells us that we cannot attain any adequate description of the phenomenon in question, unless we recognise that sentences are hierarchically structured into sets of constituents assigned to categories.

In the foregoing discussion, we have presented a number of arguments in support of postulating that sentences are hierarchically structured into constituents, each of which is assigned to a particular category. In general, these twin assumptions are uncontroversial – i.e. virtually any linguist working on Syntax from any theoretical perspective will accept the need to recognise the existence of an abstract syntactic structure associated with sentences. Where linguists disagree with each other is over the question of just how many categories there are in a particular language or universally – not over the question of *whether* there are categories.

What we have argued hitherto is that certain linguistic phenomena cannot adequately be described without assuming that every sentence in every natural language has a specific syntactic (constituent) structure. But an obvious question that arises is:

(105) How do we determine what the constituent structure of a given sentence in a given language is?

Sometimes, we can rely on intuition: but while linguists tend to acquire fairly refined intuitions about this sort of thing over a period of years, nonlinguists very frequently have few if any strong intuitions about the structure of sentences in their language. So, when our intuitions fail us, how can we determine what the constituent structure of a given sentence is?

Perhaps we can best answer this question by asking another question: 'Why do we posit the existence of constituents and categories?' The answer we have given is: 'In order to provide a principled account of e.g. distribution, coordination, intrusion, anaphora, omissibility, etc.' An obvious answer to the question: 'How do we determine whether a given sequence of words is a constituent of a given type?' is thus: 'On the basis of whether it

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behaves like a constituent of that type with respect to distribution, coordination, intrusion, anaphora, omissibility, etc.' More precisely, we might propose the following *diagnostics* for determining whether a given set of words in a sentence is a constituent or not, and if so, of what type (= category):

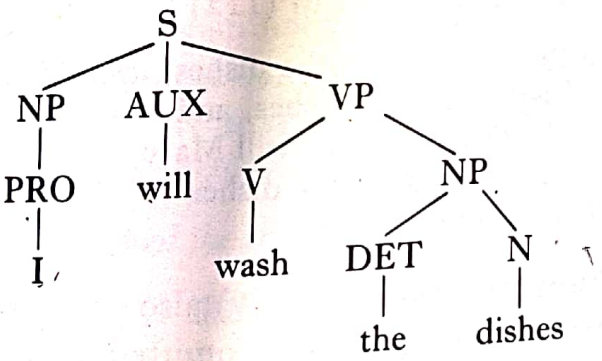
(106) A given string of elements is a *constituent* just in case it has one or more of the following properties:
- (i) It behaves distributionally as a single structural unit – i.e. it recurs as a single unit in a variety of other sentence-positions
- (ii) It can be coordinated with another similar string
- (iii) It does not readily permit intrusion of parenthetical elements internally (intrusion generally being permitted only at the boundaries of major – especially phrasal – constituents)
- (iv) It can be replaced by, or serve as the antecedent of, a proform
- (v) It can be omitted, under appropriate discourse conditions

Let's look at how we might apply these diagnostics to help us determine the constituent structure of a sentence such as:

(107) I will wash the dishes

Intuitively, it seems plausible to assign to (107) a superficial syntactic structure along the lines of:

(108)



PRO = proform – in this case, = pro-NP

Let's see first of all whether there is any motivation for assuming that the string *wash the dishes* is a constituent – a Verb Phrase (VP) in fact. If *wash the dishes* is indeed a constituent, then the *distributional* criterion (106) (i) would tell us that we would expect it to recur as a single structural chunk in a variety of other sentence-positions. And sure enough this does indeed seem to be the case, as (109) illustrates:

(109) (a) I said that I will wash the dishes, and *wash the dishes* I will
(b) What shall I do – *wash the dishes*?
(c) What I will do is *wash the dishes*
(d) There's one thing I will not do: *wash the dishes*
(e) *Wash the dishes*, will you?
(f) SPEAKER A: What will you do?
SPEAKER B: *Wash the dishes*

In addition, the coordination criterion (106) (ii) also suggests that *wash the dishes* is a constituent, since it can be conjoined with other similar strings: cf.

(110) I will *wash the dishes* and *clean the floor* (= VP and VP)

And the *intrusion* criterion (106) (iii) supports a tripartite division of the sentence into NP – AUX – VP, since it is possible for Adverbs like *certainly* to intrude between NP and AUX, and between AUX and VP, but not elsewhere:

(111) (a) I certainly will wash the dishes
(b) I will certainly wash the dishes
(c) ?I will wash certainly the dishes
(d) *I will wash the certainly dishes

The *proform* criterion (106) (iv) also suggests that *wash the dishes* is a constituent, since it can serve as the antecedent of a variety of proforms, including those italicised in (112) below:

(112) (a) I promised that I will wash the dishes, *which* I will
(b) I said that I will wash the dishes, and *so* I will
(c) I will wash the dishes, and *so* will Mary
(d) SPEAKER A: I will wash the dishes
SPEAKER B: You will *what*?

Finally, the *omissibility* criterion (106) (v) also suggests that *wash the dishes* is a constituent, since it can be omitted in an appropriate discourse setting: cf.

(113) SPEAKER A: Who will *wash the dishes*?
SPEAKER B: Mary will wash the dishes

All in all, then, there appears to be considerable empirical support for postulating that *wash the dishes* is a major constituent in the syntactic structure of sentences like (107).

There is also an equal amount of evidence for claiming that the string *the dishes* is also a constituent (an NP, or Noun Phrase) in

(107). For example, it recurs as a single distributional unit in other sentence-positions:

(114) *The dishes*, I will wash – but not the floor

Likewise, *the dishes* can be coordinated with other NPs:

(115) I will wash *the dishes* and *the floor* (NP and NP)

And *the dishes* can occur in the same sentence-positions as, and serve as the antecedent of, a pro-NP like *them*: cf.

(116) SPEAKER A: Will you wash the dishes?
SPEAKER B: Yes, I will wash them

and so on and so forth. Hence it seems clear that *the dishes* is a constituent, and furthermore a constituent belonging to the category NP.

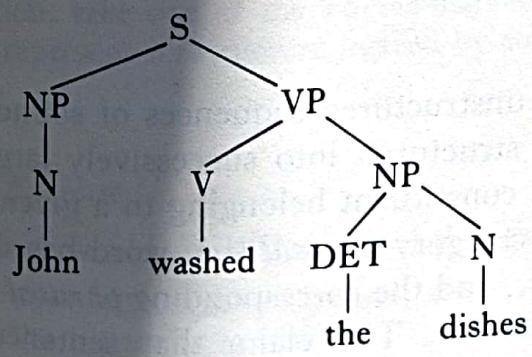
It might seem at first sight that there is something paradoxical in saying that both *wash the dishes* and *the dishes* are constituents of the sentence (107) *I will wash the dishes*. But closer reflection reveals that there is no contradiction here at all, since *the dishes* is an NP (= Noun Phrase) which is itself a constituent of (= included in) the larger VP (= Verb Phrase) constituent *wash the dishes* – as represented diagrammatically in (108).

Notice that the same arguments which we use to justify the postulation of a VP constituent in a sentence like (107) can also be used to justify the postulation of a VP constituent in sentences which contain no overt auxiliary: that is, we can argue that in an auxiliary-less sentence such as:

(117) John *washed the dishes*

the italicised string is also a VP constituent, so that (117) has the constituent structure:

(118)



For example, *washed the dishes* can occur as an independent (elliptical) sentence in an appropriate context like:

(119) SPEAKER A: What did John do?
SPEAKER B: Washed the dishes

so that distributionally it might be argued to function as a constituent. Likewise, *washed the dishes* can be coordinated with another VP: cf.

(120) John *washed the dishes* and *polished the floor*

And an Adverb like *certainly* can intrude between the NP *John* and the VP *washed the dishes*, though not elsewhere in the sentence: cf.

(121) (a) John certainly washed the dishes
(b) ?John washed certainly the dishes
(c) *John washed the certainly dishes

Likewise, *washed the dishes* can be replaced by, and serve as the antecedent of an appropriate proform: cf.

(122) SPEAKER A: John washed the dishes
SPEAKER B: John *what*?

and so on.

Overall, then, we see that we do not have to rely purely on (often rather elusive) intuitions to support the postulation of a hierarchical syntactic structure associated with sentences: to some extent, it is also possible to make use of diagnostics like (106) to confirm – or indeed refute – our intuitions. The status of 'tests' like (106) is of course purely *empirical*: they are, in general, traditional tests, but tradition is no substitute for truth. Future research may show that some – or even all – of the assumptions underlying (106) are incorrect, and have to be replaced by an alternative set which yields different results.

Summary

Sentences are not just unstructured sequences of sounds; rather, they are hierarchically structured into successively larger sets of *constituents*, with each constituent belonging to a given *category*. There are two types of category: *lexical* (i.e. word-based) categories like A, N, P, V, etc., and the corresponding *phrasal* categories like AP, NP, PP, VP, etc. The claim that sentences have a

hierarchical structure is based not simply on native speaker intuitions, but more importantly on empirical evidence relating to phonology, morphology, structural ambiguity, distribution, coordination, intrusion, anaphora, omissibility and so forth. Since sentences are hierarchically structured into words and phrases, we require of our syntactic sentence-formation rules that they specify how sentences are built up out of phrasal categories, how phrases are built up out of lexical categories, what range of words can be inserted in a given lexical category position, and so forth. To do this, we posit a set of *Phrase Structure Rules* generating abstract nonlexical (i.e. wordless) *Phrase-markers*, plus a *Lexicon* containing a list of all the words in the language and a specification of what category (or categories) they belong to, together with a *Lexical Insertion Rule* inserting words from the Lexicon under appropriate lexical categories in the P-marker.

EXERCISES

Exercise I

Draw six different Phrase-markers which can be generated by a set of Phrase Structure Rules like (1) below, together with a Lexicon containing the entries in (2):

(1) (a) S → NP – AUX – VP
(b) VP → V – NP
(c) NP → DET – (AP) – N
(d) AP → (DEG) – A

(2) *a(n)*, DET; *apple*, N; *arrest*, V; *buy*, V; *can*, AUX; *fairly*, DEG; *girl*, N; *handsome*, A; *may*, AUX; *nice*, A; *policeman*, N; *pretty*, A; *rather*, DEG; *ripe*, A; *sparrow*, N; *tall*, A; *tasty*, A; *that*, DET; *the*, DET; *this*, DET; *very*, DEG; *will*, AUX.

Are any of the structures generated by (1) and (2) ill-formed and, if so, what is the nature of their ill-formedness?

In addition, take one of the Phrase-markers generated by the above rules, and represent its structure instead by an equivalent set of labelled brackets.

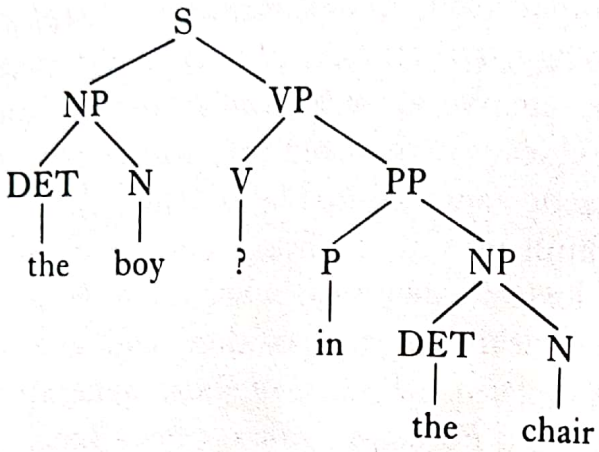
Exercise II

Many linguists would argue that one of the sentences in (1) below:

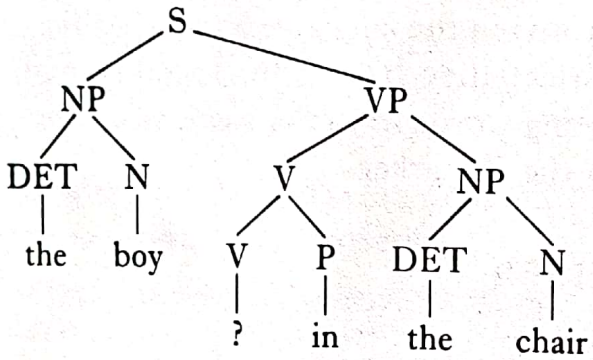
(1) (a) The boy brought in the chair
(b) The boy sat in the chair

has the structure (2) (a) below, while the other has the structure (2) (b):

(2) (a)



(2) (b)



But which sentence has which structure? In order to determine this, decide for yourself which of the sentences below *you* regard as grammatical, and which as ungrammatical (indicate ungrammaticality by a prefixed*). Then, on the basis of (106), discuss how the resultant data can be used as diagnostics to determine the constituent structure of sentences (1) (a) and (1) (b).

(3) (a) *In the chair* sat a tall, dark, handsome stranger
(b) *In the chair* brought a tall, dark, handsome stranger

(4) (a) He sat *in the chair* and *in the hammock*
(b) He brought *in the chair* and *in the hammock*

(5) (a) He sat *quietly* in the chair
(b) He brought *quietly* in the chair

(6) (a) He sometimes sits *in the chair*, but I never sit *there*
(b) He sometimes brings *in the chair*, but I never bring *there*

Exercise III

The sentences below might be argued to be *structurally ambiguous*. How might we represent this ambiguity in terms of a difference of syntactic structure?

(1) (a) I like Egyptian cotton shirts
(b) They found the boy in the library
(c) You could not go to the party
(d) John ran down my garden path

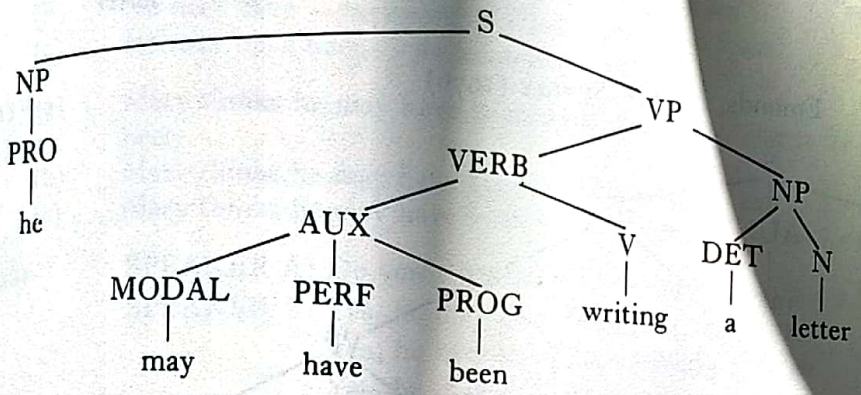
*Exercise IV

Consider the sentence:

(1) He may have been writing a letter

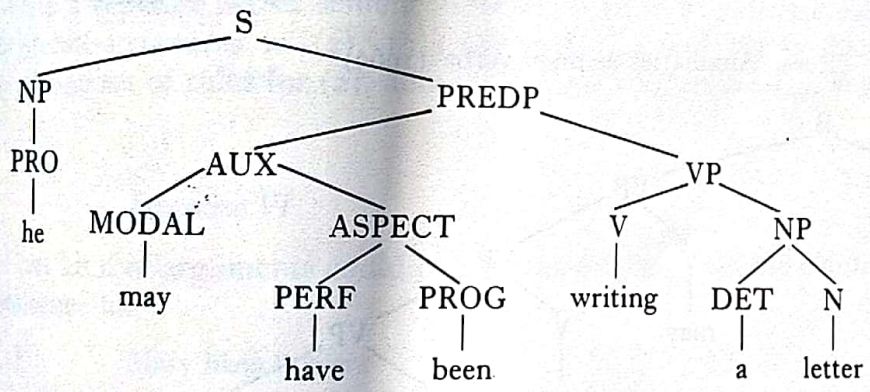
In (2)–(7) below are a number of suggested analyses of the superficial syntactic structure of this sentence (adapted in minor ways):

(2) Chomsky, *Syntactic Structures* (1957)



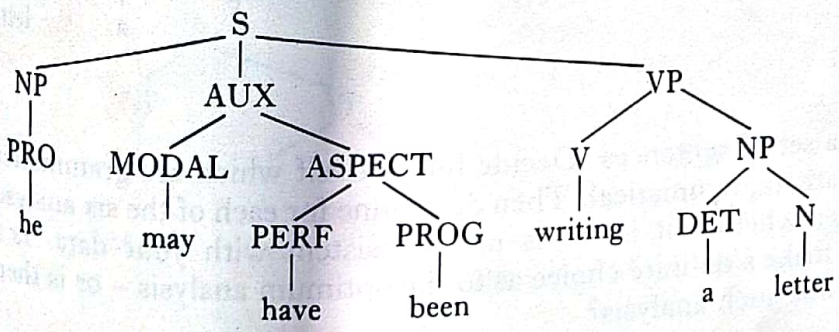
PERF = perfective auxiliary; PROG = progressive auxiliary

(3) Chomsky, *Logical Structure* (1975) (written in 1955)

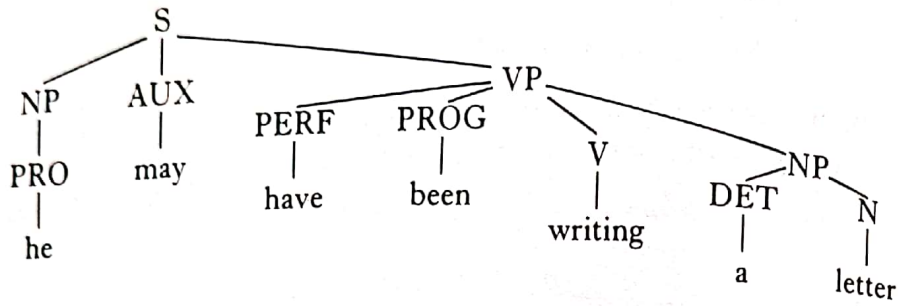


PREDP = Predicate Phrase

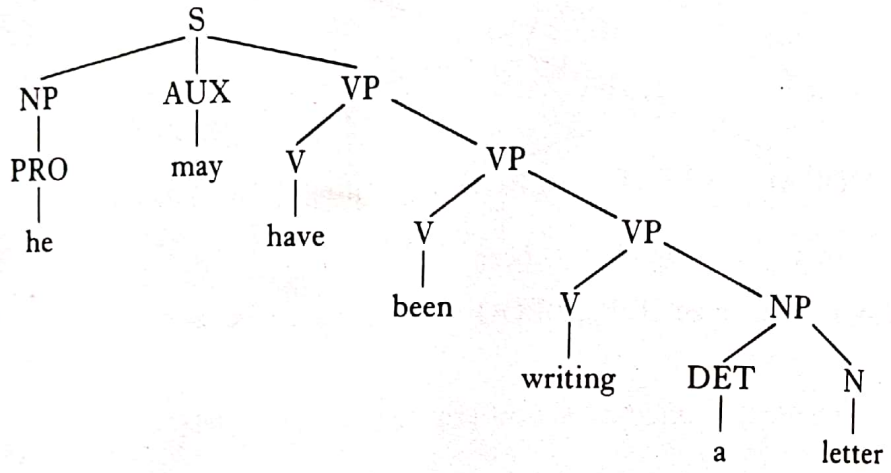
(4) Chomsky, *Studies* (1972)



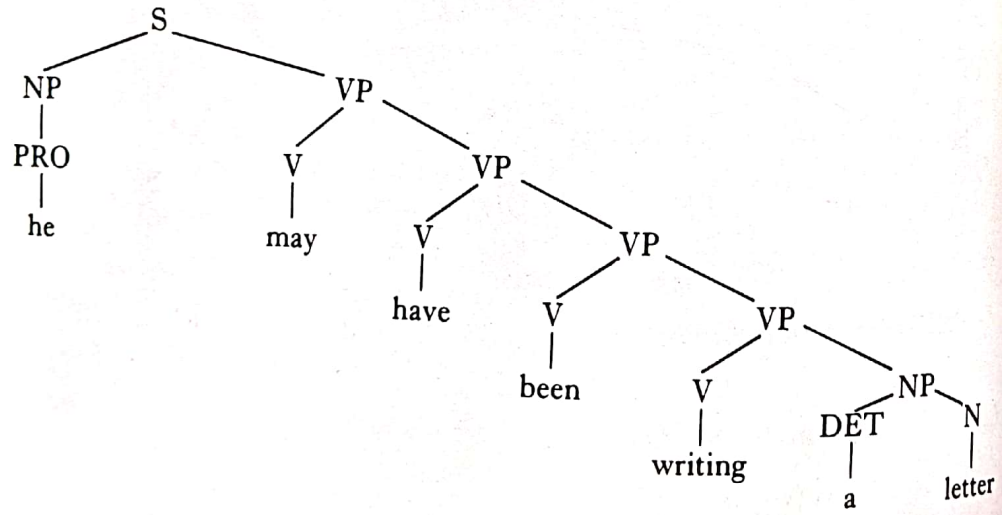
(5) Jackendoff, *Semantic Interpretation* (1972)



(6) Emonds, *English Syntax* (1976)



(7) Ross, 'Auxiliaries as main verbs' (1969)



Below are a set of sentences. Decide for yourself which are grammatical and which are ungrammatical. Then determine for each of the six analyses given earlier whether it is, or is not, consistent with your data. Is it possible to make a definite choice as to the optimum analysis – or is there more than one such analysis?

(8) SPEAKER A: What might he have been doing?
SPEAKER B: Writing a letter
Been writing a letter
Have been writing a letter

(9) (a) He may have been *writing a letter* or *watching TV*
(b) He may have *been writing a letter* or *been watching TV*
(c) He may *have been writing a letter* or *have been watching TV*

(10) (a) He may – *for example* – have been writing a letter
(b) He may have – *for example* – been writing a letter
(c) He may have been – *for example* – writing a letter

(11) (a) Mary thinks he may have been writing a letter, and *so* he may have been
(b) Mary thinks he may have been writing a letter, and *so* he may have
(c) Mary thinks he may have been writing a letter, and *so* he may

(12) SPEAKER A: Do you think he may have been writing a letter?
SPEAKER B: Yes, he may have been writing a letter
Yes, he may have been writing a letter
Yes, he may have been writing a letter

Exercise V

Write a separate set of sentence-formation rules to generate each of the sentence-structures in (2), (3), (4), (5), (6) and (7) in Exercise IV (i.e. one set of rules for (2), another for (3), another for (4), and so on).

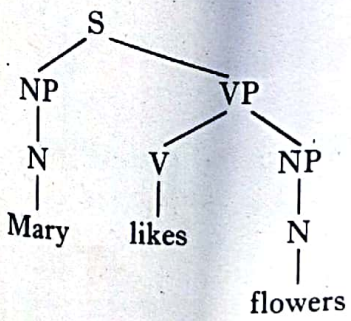
Exercise VI

What kind of arguments could be advanced to support the claim that in a sentence like:

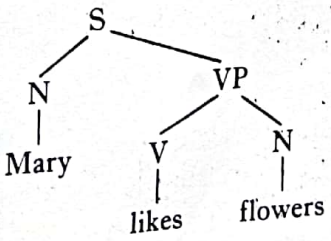
(1) Mary likes flowers

both *Mary* and *flowers* are not only Nouns, but also Noun Phrases? That is, what reasons might we give for saying that (1) has the structure (2) (a) below, not (2) (b)?

(2) (a)



(2) (b)



FURTHER READING

Akmajian and Heny (1975) *Principles*, pp. 1–75
Bach (1974) *Syntactic Theory*, pp. 37–57
Fromkin and Rodman (1978) *Introduction*, pp. 195–215
Huddleston (1976) *Introduction*, pp. 35–46
Keyser and Postal (1976) *Grammar*, pp. 1–66 (read with care: unconventional)
Palmer (1971) *Grammar*, pp. 1–134 (for historical background)

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